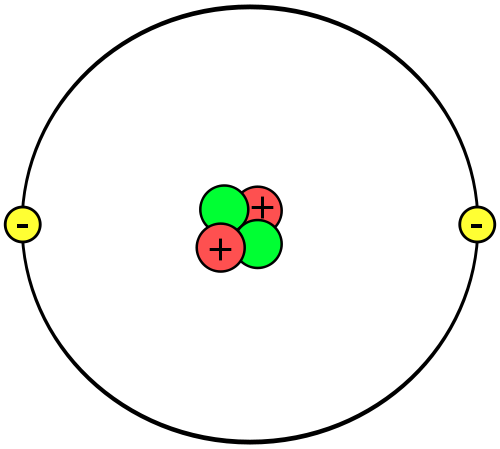


**Isotope Practice Sheet:**

Part 1:Hydrogen Isotopes: Atoms are made up of subatomic particles such as protons, neutrons, and electrons. The nuclei of atoms that make up isotopes of an element differ. There are three known isotopes of the element hydrogen. Make a drawing representing each of these isotopes. (A drawing of helium isotope is shown below as an example.)



Helium 42He Protium 11H Deuterium 21H Tritium 31H

1. Explain why the atomic mass of hydrogen is 1.0079 and not a whole number.

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2. Do the numbers of electrons for neutral isotopes of the same element differ? \_\_\_\_\_\_\_\_\_\_\_\_\_

3. Do the numbers of neutrons for such isotopes differ? \_\_\_\_\_\_\_\_\_\_\_\_\_

4. Do the numbers of protons differ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain your answer to 2, 3,& 4

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Do the atomic numbers of such isotopes differ? Explain.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Do the mass numbers of such isotopes differ? Explain

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Mass 30 29 28 27 26 25 24 23

Sample A

Abundance 100

Mass 30 29 28 27 26 25 24 23

Sample B

Abundance 11.17 10.13 78.79

Mass 56 55 54 53 52 51 50 49

Sample C

Abundance 2.38 9.56 83.76 4.31

1a. What is the atomic mass of the isotope of the element represented by spectrum A ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1b. What are the name and atomic symbol of element A? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2a. What are the atomic masses of the isotopes in spectrum B ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2b. Based on the experimentally obtained values of atomic mass and percent, calculate the average mass of this element. Show your work.

2c. What are the name and symbol of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2d. What are the symbols including superscripts and subscripts of the isotopes of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2e. Which isotope deviated most from its straight line path? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3a. What are the atomic masses of the isotopes in spectrum C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3b. Calculate the average atomic mass of this element and show your work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3c. What are the name and symbol of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3d. What are the symbols, including superscripts and subscripts of the isotopes of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3e. Which isotope deviated most from its straight line path? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Isotope Problems

1. In naturally occurring samples of the element boron, there are two kinds of isotopes, boron-10 and boron-11. The relative abundances of these isotopes in naturally occurring samples and their masses are given below. From this information, calculate the average atomic mass of boron.

Isotope Relative Abundance Atomic mass of the isotope

Boron-10 19.78 % 10.013 u

Boron-11 80.22 % 11.009 u

2. Calculate the average atomic mass of potassium if the abundance and atomic masses of the isotopes making up its naturally occurring samples are as given below.

Isotope Relative Abundance Atomic mass of the isotope

Potassium-39 93.12 % 38.964 u

Potassium-41 6.88% 40.962 u

3. Calculate the average atomic mass of magnesium based on the information provided below.

Isotope Relative Abundance Atomic mass of the isotope

Magnesium-24 78.70 % 23.985 u

Magnesium-25 10.13% 24.986 u

Magnesium-26 11.17 % 25.983 u

4. The average atomic mass of copper is 63.540 u. It is composed of two isotopes, Cu-63 and Cu-65, with atomic masses of 62.930 u and 64.928 u, respectively. What is the relative abundance (5) of these two isotopes in naturally occurring samples of copper?

More Isotope Practice:

1. Calculate the atomic mass of oxygen. The naturally occurring element consists of 99.759% O16 atomic mass 15.9949amu , 0.037% O17 atomic mass 16.99914 amu; and 0.204% O18 atomic mass 17.99916 amu.

2. The element Tadmium was found in another Galaxy. Four isotopes were found 11 TM (11.00 amu),

10 TM (10.00 amu), 12TM (12.00 amu), and 15TM (15.00amu). The relative abundances were 25.36 for TM-11,

12.56% TM-10, 40.35% TM-12, and they then ran out of material.

a. What % was the isotope Tm-15

b. What would be the atomic mass of Tadmium

3. Naturally occurring boron consists of 10B(10.013 amu) and 11B (11.009 amu). The atomic mass of boron is 10.811 amu. What is the relative abundance of each of the two isotopes?

Gift Wrapped Lab

I. Title: Gift Wrapped Lab(1 pt)

Intro: The foundation of chemistry lies in determinig the properties of matter. What is an atom? A proton? An electron? This is fundamentally an exercise in figuring out how to deduce information about what we cannot see, like individual atoms, from things which we can see(or hear, feel, or measure). In science, we call this “Model Building.” Your job in this lab is to develop and test and redevelop and re-test a series of models until you think you have arrived at the “correct” model. Basically, you are retracing some of the steps that Rutherford went through to develop his model of the atom.

II. Purpose- You come up with this in your own words(2 pts)

III. Procedure: Using any method which you think is effective, gather data about the shape of the interior of the boxes provided. YOU MAY NOT OPEN THE BOXES!!!

Write a step by step procedure of how you went about collecting your data to determine the interior of the boxes.(3 pts)

IV. Data

a. Write out a list of “observations” which you gathered during your investigation and a corresponding list of “inferences” which you made from your data.Make two columns. Be prepared to defend both your observations and inferences. You must have a minimum of 6 observations and inferences to get the maximum points. (6 pts)

b. Sketch what you think the interior of each of the gift wrapped boxes look like to scale on the attached data sheet. (12 pts=2 pts per box)

V. Analysis Questions

1. Did you change your “model” after discussion with your lab partner and other lab groups? What convinced you to change or not change? (2 pts)

2. What kinds of things could you have used to improve your modeling of the box’s interior? List some modern machines or technologies which could have aided you, and explain why they would have improved your results. (2 pts)

3. What ideas did you have as a child that you later found out were incorrect or untrue? Did you change those ideas or did someone else help/convince you to change your ideas? Were those incorrect ideas useful to you as a child even though they were incorrect? Do not use Santa Clause!! (2 pts)

4. Have there ever been any models developed by scientists which were incorrect? Using your experience from this lab, explain why scientists might develop models which do not always turn out to be true? Note: you may not use Rutherford as your example. (2 pts)

VI. Conclusion: Narrative- A new format for this lab.(8 pts)

Write a discussion about the lab which addressed the journey you took to get to your “model” (2 pts). What did you learn? (2 pts). What was the most interesting part of this lab? (2 pts). What parts were misleading in this lab? (2 pts).

Gift Box Experiment

Shade all of the areas which you believe are inaccessible to the marble located inside the box. If there is a barrier in the box, draw in its shape.

SAMPLE BOX #1 SAMPLE BOX #2

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| --- | --- |
|  |  |

BOX #1 BOX #2

|  |  |
| --- | --- |
|  |  |

BOX #3 BOX #4

|  |  |
| --- | --- |
|  |  |

BOX #5 BOX #6

|  |  |
| --- | --- |
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